

REMARKS

Reconsideration of this application is respectfully requested.

Claims 1 through 30 are cancelled by this amendment.
Claims 31 through 44 are added by this amendment.

A Supplemental Information Disclosure Statement is enclosed herewith.

The drawings have not been corrected. This is because the objectionable language "motor control circuitry" has been deleted from the claims.

In regard to the claims, claim 31 is directed to a steering system for a vehicle having first and second steerable rear wheels. The steering system includes an axle having first and second end portions which are suspended by springs and which support the first and second steerable rear wheels of the vehicle. The axle has an intermediate portion which defines a chamber in the axle. A steering member is supported for movement in the chamber in the axle. The steering member has a screw thread portion. The ball nut is associated with the screw thread portion of the steering member and is disposed in the chamber in the axle.

In addition, claims 31 sets forth an electric motor as being connected with the axle. At least one drive member is

connected with the electric motor and the ball nut to rotate the ball nut to move the steering member axially relative to the axle. A takeoff assembly is connected to the steering member and has a portion projecting from an opening in the intermediate portion of the axle. A first steering linkage is connected with a projecting portion of the takeoff assembly and extends along an outer side of the axle to transmit movement of the takeoff assembly to the first steerable rear wheel. A second steering linkage is connected with the projecting portion of the takeoff assembly and extends along the outer side of the axle to transmit movement of the takeoff assembly to the second steerable rear wheel.

Claim 31 defines over the prior art, and particularly the patent to Ohmura, et al. (5,077,494), Cartwright (6,098,742), and Shimizu (4,837,692), by setting forth the relationship between the axle, steering member, ball nut, electric motor, takeoff assembly, and first and second steering linkages. Specifically, the patents to Ohmura, et al., Cartwright and/or Shimizu do not disclose an axle in which a steering member is disposed. Even more specifically, these patents do not disclose an axle in which a steering member and ball nut are disposed and with which an electric motor is connected. Furthermore, these patents

do not disclose a takeoff assembly which projects from an opening in an intermediate portion of an axle and is connected with first and second steering linkages in the manner set forth in claim 31.

Claims 32 through 44 depend from claim 31 and define over the prior art for substantially the same reasons as does claim 31 and by virtue of the structure and function set forth in these claims taken in combination with the structure and function of claim 31. Specifically, claim 32 sets forth a spring assembly as being disposed in the chamber in the axle. The spring assembly biases the steering member toward a straight ahead position. The patent to Ohmura, et al. does disclose a spring assembly. However, the spring assembly of Ohmura, et al is not disposed in a chamber in an axle.

Claim 33 depends from claim 31 and sets forth a spring assembly as being disposed in the chamber in the axle. The spring assembly includes a single spring which acts to bias a steering member in a first axial direction toward a straight ahead position when the steering member is moved from the straight ahead position. The single spring also biases a steering member in a second axial direction toward the straight ahead position when the steering member is moved from the straight ahead position in the first axial

direction. The patent to Ohmura, et al. does disclose a spring. However, the patent to Ohmura, et al. does not disclose a spring which is disposed in the chamber in an axle.

Claim 34 depends from claim 33 and sets forth fixed stops as being disposed in the chamber in the axle. The steering movable has movable stops that are movable relative to the fixed stops to compress the spring upon movement of the steering member from the straight ahead position. There is nothing in the patents to Ohmura, et al., Cartwright, and/or Shimizu which even remotely suggests having fixed stops and movable stops disposed in an axle in the manner set forth in claim 34.

Claim 35 depends from claim 31 and sets forth a spring assembly as being disposed in the chamber in the axle. The takeoff assembly includes a piston located between the ball nut and the spring assembly. The spring assembly is effective to urge the takeoff assembly toward a straight ahead position. The patent to Ohmura, et al. (5,077,494) does not disclose a takeoff assembly having a piston located between a ball nut and a spring assembly and wherein the spring assembly is effective to urge the takeoff assembly toward a straight ahead position. The patent to Cartwright (6,098,742) does not disclose a piston located between a

ball nut and a spring assembly and wherein the spring assembly is effective to urge the takeoff assembly toward a straight ahead position. The patent to Shimizu (4,837,692) does not disclose a takeoff assembly having a piston located between a ball nut and a spring assembly and wherein the spring assembly is effective to urge the takeoff assembly toward a straight ahead position.

Claim 36 depends from claim 35 and sets forth a first stop means spaced apart from the piston and acting between a spring in a spring assembly and the steering member for transmitting biasing force of the spring to the steering member.

Claim 37 depends from claim 31 and sets forth a first spring member acting between the takeoff assembly and the axle. The first spring member biases the takeoff assembly and the steering member in the first axial direction toward a straight ahead position. The second spring member acts between the takeoff assembly and the axle. The second spring member biases the takeoff assembly and the steering member in a second axial direction opposite the first axial direction and toward the straight ahead position. The patents to Ohmura, et al., Cartwright, and Shimizu do not disclose first and second spring members which act between

the takeoff assembly and an axle and are effected to bias a takeoff member in the manner set forth in claim 37.

Claim 38 depends from claim 31 and sets forth the takeoff assembly as including a piston member connected with a steering member and supported in the axle for movement with the steering member relative to the axle. The piston member has axially opposed first and second end surfaces. A first spring member acts between the first end surface of the takeoff assembly and the axle. A second spring member acts between the second end surface of the takeoff assembly and the axle. The patents to Ohmura, et al., Cartwright, and Shimizu do not disclose first and second spring members which act between a takeoff assembly and an axle in the manner set forth in claim 38.

Claim 39 depends from claim 31 and sets forth a motor control system which is operative to enable the generation of back EMF in the motor upon movement of the steering member toward the straight ahead position in order to resist movement of the steering member toward the straight ahead position. Claims directed to this general concept were previously objected to by the Examiner because the drawings do not disclose "motor control circuitry". However, the drawings clearly show a motor control system 150 (Fig. 1).

Claim 40 depends from claim 31 and sets forth the electric motor as being located outside the chamber in the axle. The drive member extends through an opening formed in the axle.

Claim 41 depends from claim 31 and sets forth the steering member as being free of rack teeth.

Claim 42 depends from claim 31 and sets forth the electric motor as being effective to cause generation of back EMF to resist movement with the steering member toward a straight ahead position.

Claim 43 depends from claim 31 and sets forth a locking member to lock the steering member in a straight ahead position.

Claim 44 depends from claim 31 and sets forth a drive member as being a belt which extends partway around the ball nut and partway around an output member connected with the electric motor.

Independent claim 45 is directed to a steering system for a vehicle having first and second steerable rear wheels. The steering system includes a steering member which is supported in a chamber in a housing. A ball nut is associated with a screw thread portion of the steering member and is disposed in the chamber in the housing. An electric motor is connected with the ball nut to rotate the

ball nut to move the steering member axially relative to the housing upon actuation of the electric motor.

In addition, claim 45 sets forth a spring assembly as being disposed in the chamber in the housing. The spring assembly biases the steering member toward a straight ahead position. A takeoff assembly is connected with the steering member and has a portion projecting from an opening in the housing. A first steering linkage is connected with the projecting portion of the takeoff assembly and extends along an outer side of the housing to transmit movement of the takeoff assembly to the first steerable rear wheel. A second steering linkage is connected with the projecting portion of the takeoff assembly and extends along the outer side of the housing to transmit movement of the takeoff assembly to the second steerable rear wheel.

Claim 45 defines over the prior art and particularly the patents to Ohmura, et al. (5,077,494), Cartwright (6,098,742) and Shimizu (4,837,692), by setting forth a relationship between the housing, steering member, ball nut, electric motor, spring assembly, takeoff assembly and first and second steering linkages. Specifically, the patents to Ohmura, et al., Cartwright, and/or Shimizu do not disclose a housing having a takeoff assembly connected with a steering member. In addition, these patents do not disclose first

and second steering linkages connected with the projecting portion of the takeoff assembly and extending along an outer side of the housing to transmit movement of the takeoff assembly to steerable rear wheels of a vehicles.

Claims 46 through 57 depend from claim 45 and define over the prior art for substantially the same reasons as does claim 45 and by virtue of the structure and function set forth in these claims. Specifically, claim 46 sets forth the spring assembly as comprising a single spring acting to bias the steering member toward a straight ahead position when the steering member is moved from the straight ahead position.

Claim 47 depends from claim 46 and sets forth fixed stops as being disposed in the chamber in the housing. The fixed stops capture the spring on the steering members in a straight ahead position. The steering member has movable stops that are movable relative to the fixed stops to compress the spring upon movement of the steering member from the straight ahead position.

Claim 48 depends from claim 45 and sets forth the takeoff assembly as comprising a piston located between the ball nut and spring assembly. The spring assembly is effective to urge the takeoff assembly toward a straight ahead position.

Claim 49 depends from claim 48 and sets forth a stop means as being spaced from the piston and acting between a spring and a spring assembly in a steering member to transmit biasing force of the spring to the steering member.

Claim 50 depends from claim 45 and sets forth the spring assembly as including a first spring member acting between the takeoff assembly and the housing. The first spring member biases the takeoff assembly in a first axial direction toward a straight ahead position. A second spring member acts between the takeoff assembly and the housing. The second spring member biases the takeoff assembly and thereby the steering member in a second axial direction opposite the first axial direction and toward the straight ahead position.

Claim 51 depends from claim 45 and sets forth the takeoff assembly as including a piston member which is connected with the steering member. The piston member is supported in the housing for movement with the steering member relative to the housing. The piston member has an axially opposed end surfaces. A first spring member acts between a first end surface of the takeoff assembly and the housing. A second spring member acts between a second end surface of the takeoff assembly and the housing.

Claim 52 depends from claim 45 and sets forth a motor control system as being operative to enable the generation of a back EMF in the motor upon movement of the steering member toward the straight ahead position. This enables the motor to resist movement of the steering member toward the straight ahead position.

Claim 53 depends from claim 45 and sets forth the electric motor as being located outside the chamber in the housing. The drive member extends through an opening formed in the housing.

Claim 54 depends from claim 45 and sets forth the housing as being axle which is suspended by vehicle springs. The axle supports the first and second rear wheels of a vehicle.

Claim 55 depends from claim 45 and sets forth the electric motor as being effective to resist movement of the steering member toward a straight ahead position.

Claim 56 from claim 55 and sets forth a locking member for locking the steering member in a straight ahead position.

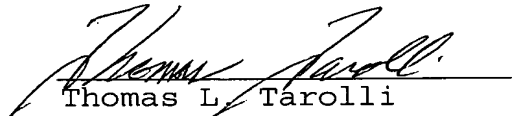
Claim 57 depends from claim 45 and sets forth a belt which extends partway around the ball nut and partway around the output member as being connected with the electric

motor. The belt interconnects the electric motor and the ball nut.

In view of the foregoing remarks, it is believed that the claims in this application clearly and patentably define over the prior art. Therefore, it is respectfully requested that the claims be allowed and this application pass to issue.

If for any reason the Examiner believes that a telephone conference would expedite the prosecution of this application, it is respectfully requested that the Examiner call applicant's attorneys in Cleveland, Ohio at 621-2234, area code 216. Please charge any deficiency in the fees for this application to our Deposit Account No. 20-0090.

Respectfully submitted,


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